

Claims

[c1] What is claimed is:

1. A white-light emitting device comprising:

a first LED; and

at least one first phosphor $\text{ZnS Se}_x\text{Se}_{1-x}$ ($0 < x < 1$) containing at least one activator among Cu, Ag and Au, and sending forth light when stimulated by rays irradiated from said first LED.

[c2] 2. A white-light emitting device as set forth in claim 1,

wherein said first phosphor is $\text{ZnS Se}_x\text{Se}_{1-x}$ ($0.2 \leq x \leq 0.9$), and sends forth light when stimulated by rays in a range of wavelengths 380 nm to 500 nm irradiated from said first LED.

[c3] 3. A white-light emitting device as set forth in claim 1,

wherein said first phosphor $\text{ZnS Se}_x\text{Se}_{1-x}$ ($0 < x < 1$) further contains at least one coactivator among Cl, Br, I, Al, In and Ga.

[c4] 4. A white-light emitting device as set forth in claim 1,

wherein said first phosphor $\text{ZnS Se}_x\text{Se}_{1-x}$ ($0 < x < 1$) is in either a clumplike or powdered form.

[c5] 5. A white-light emitting device as set forth in claim 1, wherein said first phosphor is $\text{ZnS}_x\text{Se}_{1-x}$ ($0.5 \leq x \leq 0.9$), contains at least one of the activators Au and Cu, and sends forth light when stimulated by rays in a range of wavelengths 410 nm to 490 nm irradiated from said first LED.

[c6] 6. A white-light emitting device as set forth in claim 1, wherein said first phosphor is $\text{ZnS}_x\text{Se}_{1-x}$ ($0.4 \leq x \leq 0.5$), contains the activator Ag, and sends forth light when stimulated by rays in a range of wavelengths 410 nm to 490 nm irradiated from said first LED.

[c7] 7. A white-light emitting device as set forth in claim 1, further comprising a second LED, said second LED for irradiating red light; wherein:
said first phosphor $\text{ZnS}_x\text{Se}_{1-x}$ ($0 < x < 1$) is at least one of a phosphor $\text{ZnS}_x\text{Se}_{1-x}$ ($0.7 \leq x \leq 0.9$) containing at least one of the activators Au and Cu, and a phosphor $\text{ZnS}_x\text{Se}_{1-x}$ ($0.5 \leq x \leq 0.8$) containing the activator Ag;
and
said first LED irradiates rays in a range of wavelengths 410 nm to 490 nm.

[c8] 8. A white-light emitting device as set forth in claim 1, further comprising a second phosphor, said second phosphor for sending forth light of wavelength longer

than that from said first phosphor; wherein:

said first phosphor ZnS Se_x^{1-x} ($0 < x < 1$) is at least one of a phosphor ZnS Se_x^{1-x} ($0.7 \leq x \leq 0.9$) containing at least one of the activators Au and Cu, and a phosphor ZnS Se_x^{1-x} ($0.5 \leq x \leq 0.8$) containing the activator Ag; and

both said first and second phosphors send forth light when stimulated by rays in a range of wavelengths 410 nm to 490 nm irradiated from said first LED.

[c9] 9. A white-light emitting device as set forth in claim 1, further comprising a second phosphor, said second phosphor being ZnS Se_x^{1-x} ($0.2 \leq x \leq 0.4$) and containing at least one of the activators Au and Cu; wherein:
said first phosphor ZnS Se_x^{1-x} ($0 < x < 1$) is at least one of a phosphor ZnS Se_x^{1-x} ($0.7 \leq x \leq 0.9$) containing at least one of the activators Au and Cu, and a phosphor ZnS Se_x^{1-x} ($0.5 \leq x \leq 0.8$) containing the activator Ag; both said first and second phosphors send forth light when stimulated by rays in a range of wavelengths 410 nm to 490 nm irradiated from said first LED.

[c10] 10. A white-light emitting device as set forth in claim 1, further comprising a second phosphor, said second phosphor for sending forth green light; wherein
said first phosphor ZnS Se_x^{1-x} ($0 < x < 1$) is a phosphor ZnS Se_x^{1-x} ($0.2 \leq x \leq 0.4$) containing at least one of the

activators Au and Cu; and

both said first and second phosphors send forth light when stimulated by rays in a range of wavelengths 410 nm to 490 nm irradiated from said first LED.

[c11] 11. A white-light emitting device as set forth in claim 1, wherein said phosphor $\text{ZnS}_x\text{Se}_{1-x}$ ($0 < x < 1$) is in clump-like form and is mounted on, so as to mate surfaces with, said first LED.

[c12] 12. A white-light emitting device as set forth in claim 1, further comprising a heat-dissipating member surrounding said first LED; wherein said phosphor $\text{ZnS}_x\text{Se}_{1-x}$ ($0 < x < 1$) is in clumplike form and is mounted on, so as to mate surfaces with, said heat-dissipating member.

[c13] 13. A white-light emitting device as set forth in claim 1, wherein an InGaN LED is utilized for said first LED.

[c14] 14. A white-light emitting device as set forth in claim 1, wherein said first phosphor $\text{ZnS}_x\text{Se}_{1-x}$ ($0 < x < 1$) is heat-treated in an atmosphere containing Zn vapor.

[c15] 15. A phosphor-manufacturing method comprising: a step of forming a phosphor $\text{ZnS}_x\text{Se}_{1-x}$ ($0 < x < 1$) containing at least one among coactivators Cl, Br, I, Al, In and Ga; and

a step of carrying out a process, within a vaporous mixture of a vapor of at least one of activators Au, Cu and Ag and a vapor of Zn, of heating said coactivator-containing phosphor $\text{ZnS}_x\text{Se}_{1-x}$ ($0 < x < 1$) to the vaporous mixture temperature.

[c16] 16. A phosphor manufactured by the phosphor-manufacturing method set forth in claim 15.

[c17] 17. A white-light emitting device comprising a phosphor manufactured by the phosphor-manufacturing method set forth in claim 15.